Moving Energy Storage from Concept to Reality:

Southern California Edison's Approach to Evaluating Energy Storage

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Energy storage decision D 13-10-040 requires SCE to procure 580 MW of energy storage by 2020 and gives SCE the opportunity to own up to 290 MW.

ENERGY STORAGE REQUIREMENTS						
Storage Grid Domain (in MW)	**2014**	**2016**	**2018**	**2020**	**Total**	**Total Range**
Transmission	50	65	85	110	310	62 - 458
Distribution	30	40	50	65	185	37 - 433
Customer	10	15	25	35	85	85
Total	**90**	**120**	**160**	**210**	**580**	**580**

FLEXIBILITY:

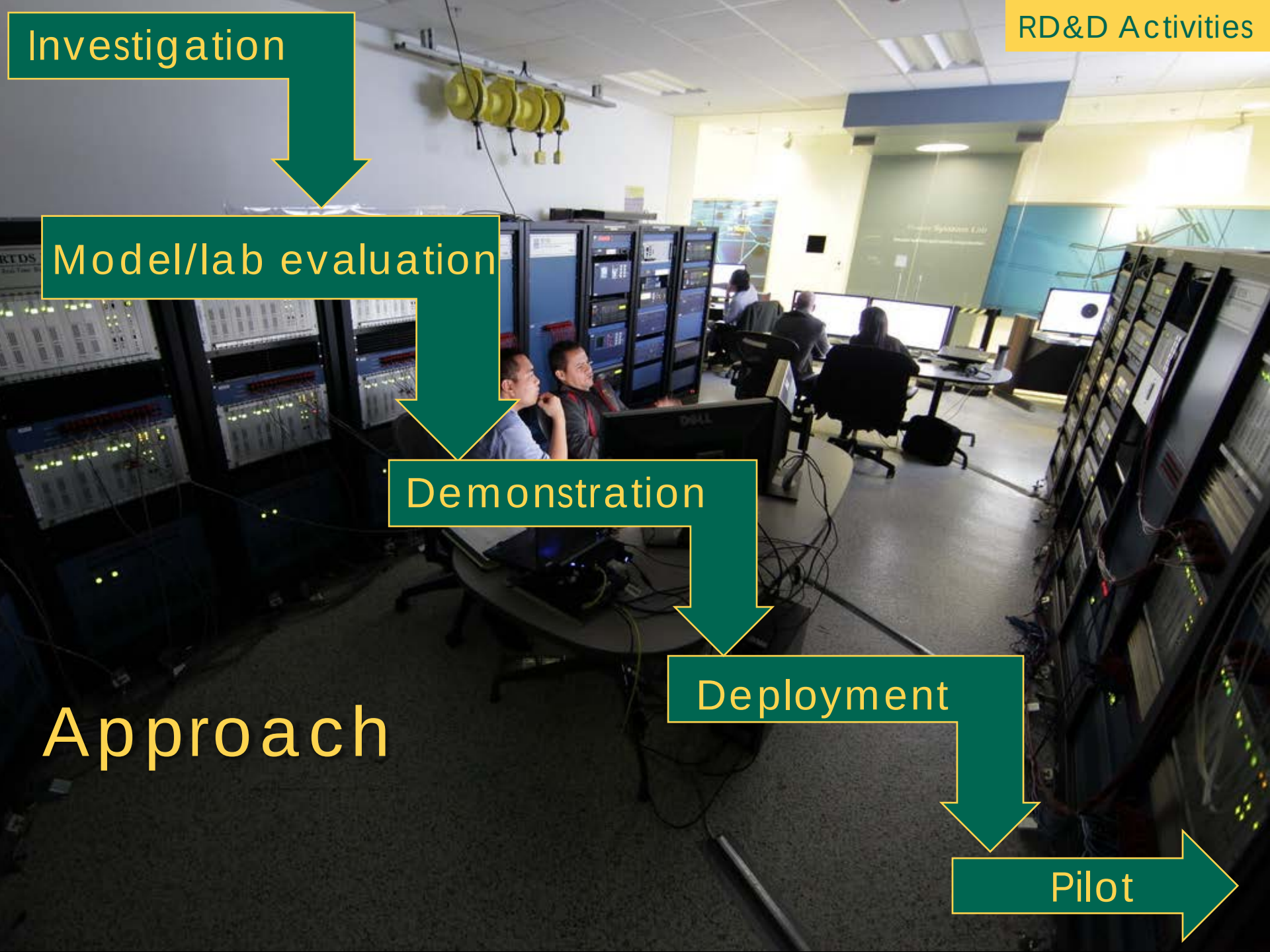
- Up to 50% of total procurement goal can be utility-owned
- Up to 80% of MWs can be shifted between Transmission /Distribution buckets
- All projects must be installed and operational by 2024

SCE Procurement Activity

- LCR RFO Contracts
  - 100.5 MW of grid connected
  - 160.6 MW of behind the meter

- Energy Storage RFO
  - Will be launched by December 1
  - Will be soliciting for grid connected storage

SCE Utility Owned Storage Activities


Investigation
Model/lab evaluation
Demonstration
Deployment
Pilot

Approach

Evaluation Steps

Electrochemical Energy Storage Evaluation

- Assess various chemistries for performance and potential cost reduction
- Determine battery operational life
- Provide input for strategic planning

System Evaluation

- Validate full system performance
- Validate control system
- Prepare documentation for field installation
- Train field personnel
- Engage internal and external stakeholders

Field Evaluation

- Demonstrate functionality and values in actual application
- Engage internal and external stakeholders

Field Evaluation

Demonstration Programs: Assess Technical Merit

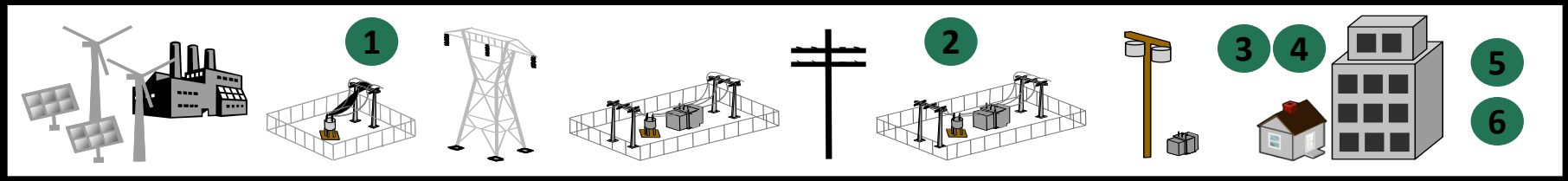
- Demonstrate Functionality
- Demonstrate Potential Value Streams
- Demonstrate Reliability

Pilot Programs: Provide a Functional System

- Resolve a Grid Problem
- Increase Operational Excellence
- Capture Value Streams
- Pursue Standardization

Deployment: Mainstream Grid Device

Demonstration Activities



1 **Tehachapi Storage Project**
Large-Scale Energy Storage (8MW/32MWh – Q2 2014)

2 **Large Commercial PLS Program (100kW/500kWh – Q2 2014)**

Irvine Smart Grid Demonstration

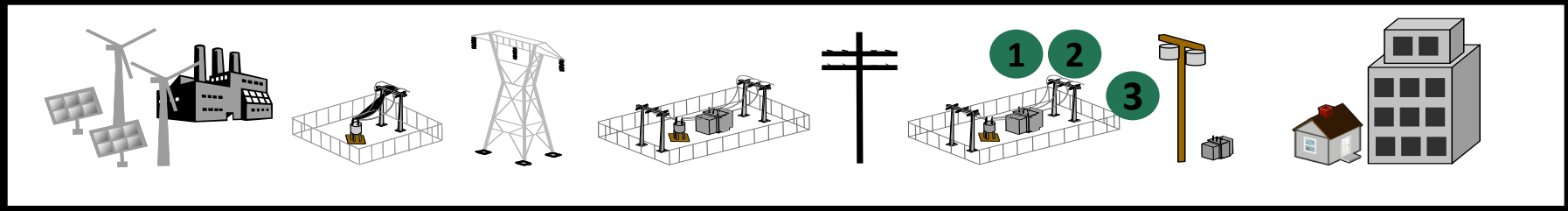
3 Large Distributed Energy Storage (2MW/500kWh unit – Q2 2014)

4 Large-Scale Community Energy Storage (CES) (100kW/100kWh – Q4 2013)

5 Community Energy Storage (CES) (25kW/50kWh – Q2 2013)

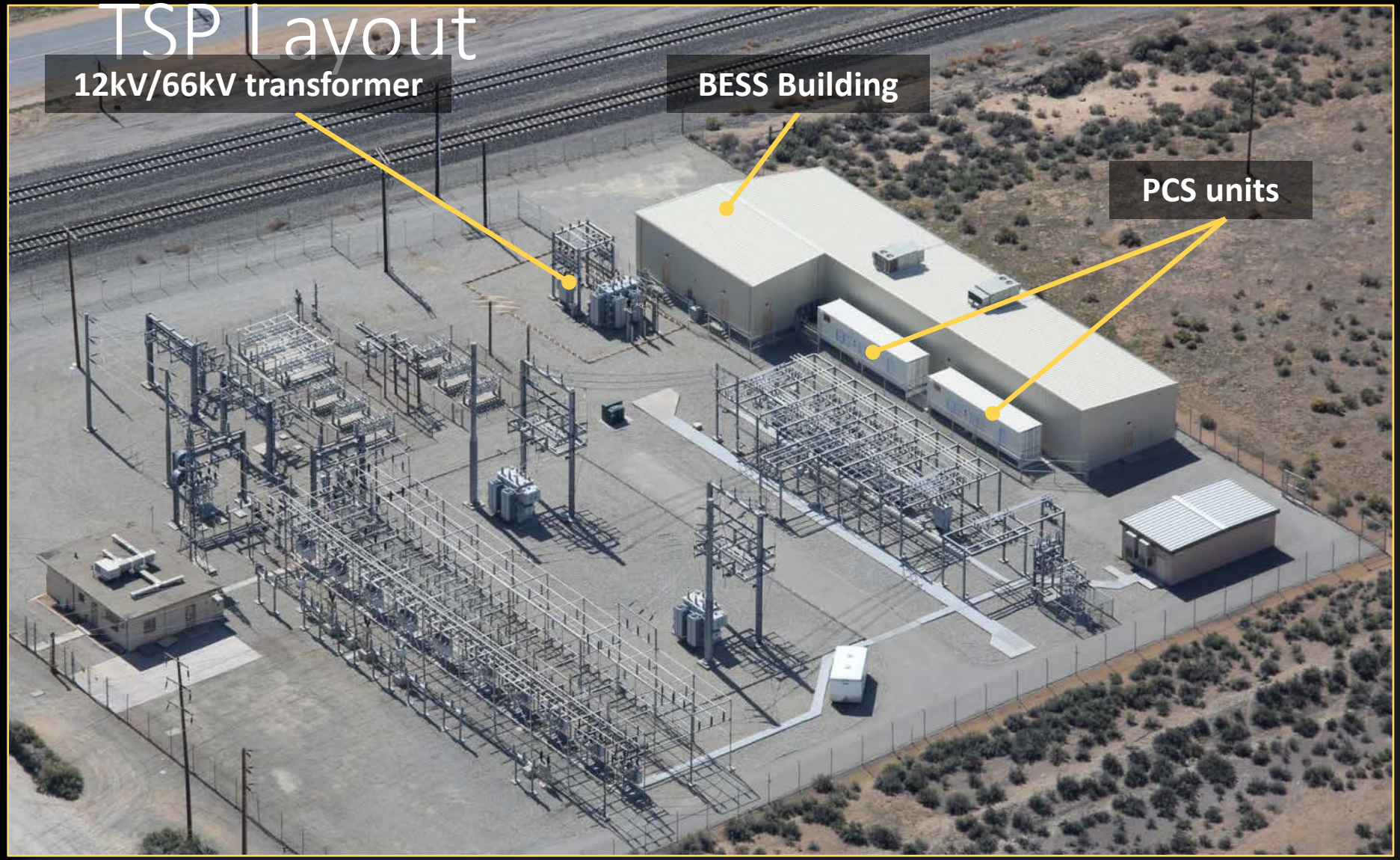
6 Residential Home Energy Storage Unit (RESU) (4kW/10kWh – Q3 2013)

Pilot and Demonstration Activities (2014-2016)



1. **Distributed Energy Storage Integration (DESI 1) Pilot Program (approx. 2MW/4MWh – Q4 2014)**
   - Deploy energy storage on the distribution system to solve a challenge or for economic benefit
2. **Distribution Optimized Storage (DOS) (1MW/1MWh – 2015)**
   - Evaluate aggregated energy storage units on the distribution system with optimized controller
3. **Distributed Energy Storage Integration (DESI 2) Pilot Program**
   - Finalization of design for storage system, communication and interconnection

TSP Layout

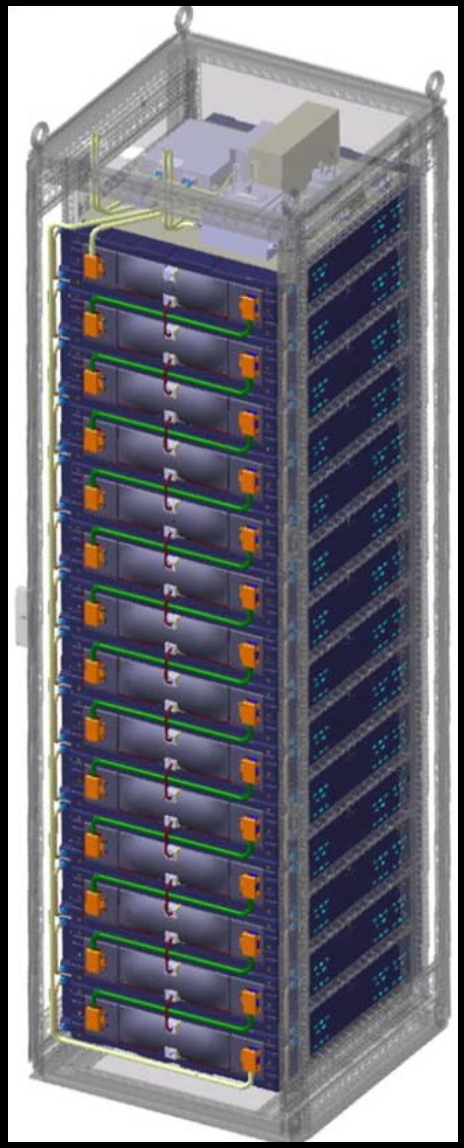


Battery Energy Storage System

How to Scale Li-ion Storage Systems

x 56

x 18



Cell
- 3.7V
- 60Wh
- 380g

Module
- 52V
- 3.2kWh
- 40kg

Rack
- 930V
- 58kWh
- 950kg


Battery Configuration
•8 MW/32MWh System
•56 cells per module
•18 modules per rack
•604 Racks
608,832 Cells

Mini System at EVTC

Mini System at EVTC

PCS Controller at RTDS Lab


Thank You